IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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Title: Electrical Outlet Box with Secure Quick Connect and Release Features

Filing Date:

Serial No:

Attorney No: TA-3109

Examiner:

Art Unit:

Confirmation No:

GOVERNMENT INTEREST

[0001] The invention described herein may be made, used, and licensed by, or for, the United States Government for governmental purposes without paying me any royalty.

BACKGROUND AND SUMMARY

[0002] This invention pertains to junction or electrical outlet boxes which are used for receiving one or more power cables and connecting thereto one or more electrical devices, housed within said boxes, to provide power to one or more external electrical appliances by means of a connector, plug, jack, or like device. More particularly, this invention provides a box suitable for wiring such devices with a secure, quick connect and release capability. It is to be understood herein that proper procedures must be followed when working with electrical devices to prevent shock or harm. Namely, the connection to the power source should be open or disconnected.

[0003] An electrical outlet or junction box is provided herein for interiorly accommodating at least one electrical device and at least one cable that have been furnished to said box by a manual source. A secure, quick connect and release capability for electrically connecting said cable and said electrical device in this box is supplied by one or more terminal blocks that are mounted to at least one interior surface of said box. The blocks carry at least one receiving means and at least one releasing means along an surface. The electrical device is then energized by supplying said cable with electricity from an external power source. The box, itself, comprises a rear wall which is perimetrically bounded by an outer wall that extends outwardly from said rear wall to define an integral structure with an open front opposite of the rear wall. The box is closed by use of an apertured faceplate or cover to protect the box interior, the cable, and the electrical device from debris and moisture as well as to provide safety by limited access and fire containment. The faceplate is dimensioned and shaped to assist mounting of the electrical device within said box and to also accommodate receipt of an electrical connector from a major electrical appliance that is external

to said box and not a part of this invention. This box is conveniently mounted to any structure by its placement within a suitable aperture previously formed within a wall, ceiling, or floor of the structure using conventional skills.

[0004] Previous innovations over the years for outlet boxes have provided better ways for mounting the box, retaining the electrical devices and wiring, and securing the cables. Typically, these boxes are produced from either metals or metal alloys using conventional metal working technologies. They are also made of rubbers, rubber composites, plastics, plastic composites, reinforced plastics, and combinations thereof by conventional molding processes which employ one or more operating steps.

[0005] Traditionally, these boxes are supplied to the trade in a variety of geometric sizes and shapes based upon their ultimate application. The most prevalent concerns in the art are to provide adequate volumes for housing the electrical devices and the various wiring components. I therefore anticipate that my boxes will also be made from these materials and will have similar sizes or shapes. Alternatively, a commercial box may be purchased and modified to provide the quick connect and release features of my invention.

[0006] A typical commercial box comes with at least one aperture therein that is formed in at least one wall, such as the top, rear, bottom, or side walls. This aperture may also be supplied as a preformed, weakened structure, known in the art as knock-outs, punch-outs, and the like. These openings allow ready ingress and egress to the internal volume of an outlet box by one or more, uncut, sheathed cables.

[0007] In a typical installation procedure, the cables are stripped of their sheathing to reveal three insulated, solid conductors (live, neutral, and ground). Thereafter, the conventional techniques of a tradesman are applied to strip the insulation from the conductor tip to thereby expose a solid wire. As used herein, wiring components are exemplified by the proceeding cables, conductors, and wires. It is also understood herein that wires composed of multiple strands may be used in this invention provided that they are first solidified by solder or tinning procedures to adequately perform as a solid wire during my installation

process. Thereafter, the solid wire is used to connect the electrical device and box together. Any cables that exit the box do so through the same or similar apertures to make further connections within the structure being electrified.

[0008] Typical electrical devices powered by solid conductors will include receptacles, sockets, switches, and electrical fixtures. Fixture examples are phone jacks, computer jacks, cable TV terminals, local area network (LAN) jacks, or any of the combinations thereof. The opening of an outlet box is then closed by a face plate or cover that has one or more apertures therein which are dimensioned and shaped to receive and/or accommodate a powered electrical connection to an external electrical appliance by the use of simple connectors. Other functions of the faceplate are to shelter the internal contents within the box from debris and moisture, to provide safety by preventing the spread of fire from the box, and to reduce easy access to the box interior and its contents. Internal contents, as used above, refers to the wiring components, the electrical device, and the quick connect and release features of my invention supplied by terminal blocks to be further discussed below. Usually, the faceplate or cover is made of the same materials as the outlet box, and the continuation of this practice is also contemplated herein. As used herein, electrical connectors contemplate prongs, plugs, jacks, and like connectors that have been previously used to energize major appliances.

[0009] These boxes may also be used as junction boxes to join electrical cables together to improve reliability, as compared to having just one cable, to supply electricity throughout an entire structure. Dependent upon the particular service need, the electrical outlet or junction boxes herein can also be joined together, in gangs or clusters, consisting of side by side, back to back, and bottom to top arrangements.

[0010] A particular problem with today's prior art is that elongated stripped-conductor tips are routinely joined by twisting, and thereafter forcing the resulting rigid mass into a suitable coupling device, such as a wire nut. For good electrical conductivity, it is essential that the tradesman apply sufficient force to the wire nut and twisted conductors to make a satisfactory connection. This is

frequently a time consuming and difficult task to perform since the conductors and attendant wires are rigid and difficult to permanently twist together by either mechanical or manual methods. It is therefore no surprise that the principal costs of wiring new or remodeled structures are for the skilled labor of either an electrician or a tradesman.

[0011] Present day electrical systems of industrial sites; homes; businesses; and water, ground, or air transports, are composed of a plurality of wiring connections that are made in the above manner. The space within the outlet box becomes unusually confined after crowding therein the wire nuts, stiff conductors, electrical devices, and the like. This problem has led to the modern development of boxes with deeper or adjustable walls to form larger volumes.

[0012] From time to time, it is necessary for someone to inspect and/or trouble-shoot an electrical system. It is often difficult for an inspector to dress or trace the numerous cables, conductors, and wires of a standard outlet box from their origin to end. This task is rendered all the more complex due to the confined space of the outlet box. As more stress is applied to the electrical connections to complete said inspection, the possibility of electrical shorts or loss of conductivity is all the more probable because of the potential disengagement of a wire nut or separation of an electrical connection.

[0013] This undesirable situation is further exacerbated when the affected electrical system is a crucial part of a much larger, integrated-system, such as a military installation; a weapons system or combat transport; a public safety facility, like a prison, police station, or fire hall; and/or a health care facility with life-support equipment located therein. Because such facilities have unique power requirements, it is unlikely that considerable time will be available to find a quick solution for an electrical problem using today's procedures and equipment as above described. As an immediate consequence, severe injury or death may be a possible outcome of any delay in a troubleshooting process.

[0014] The prior art does not disclose the many advantages and benefits of my invention; nor do they teach or suggest my inventive approach or elements. My invention will conceptually terminate the use within the art of wire

nuts and like connectors, will eliminate the tedious task of twisting wires, will reduce time for connection or disconnection of wires, and will allow the ready tracing or dressing of wires in quick order.

[0015] It is therefore an object of the claimed invention to provide a secure, quick, and easy connect or disconnect means for connecting one or more conductors electrically within a junction or outlet box. The adoption of this invention will also allow for the quick and easy verification of the origination and departure of a conductor at an electrical junction or outlet box by minimal effort.

[0016] These and other objects, features, and advantages of this invention will be apparent to those skilled in the relevant arts upon a full reading of this specification and the appended claims which explain and define the aspects and principals of this invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Figure 1 is an exploded view in perspective of a wired outlet box of the prior art partially broken away to reveal electrical connections and overall assembly techniques.

[0018] Figure 2 is an exploded view in perspective of an outlet box of this invention partially broken away to reveal its assembly.

[0019] Figure 3 is an enlarged section taken from the encircled portion of terminal block 20 of Figure 2 with its prevalent, visible external features displayed with regard to assembly and release.

[0020] Figure 4 is a perspective view of the top cell from Figure 3, resting upon its back, that has been partially broken away to reveal the conductor tips piercing the receiving means and resting upon the gripping means that are used to grasp and/or release conductors inserted therein by manual force.

[0021] Figure 5 is a section taken along the line 5-5 of Figure 4 showing the further act of insertion of bare conductor tips into the receiving and gripping means of this invention and their subsequent release by insertion of a depression tool within a depression slot of this invention.

DETAILED DESCRIPTION

[0022] To further illustrate my invention, reference is now made to Figure 1 which is a perspective view, in breakaway section, of an outlet box **10** of the prior art. Therein, three wire nuts have been employed to make electrical connections between an electrical device **11** and three or more solid conductors within the box. Further, the joined conductor tips are held together by wire nuts which respectively secure groups of live wires **12**, neutral wires **14**, and ground wires **16**. The three wires extending out of this box are then used to establish the electrical connections that are necessary to energize the device **11**. Thereafter, a preselected external electrical connector (not shown) of an electrical appliance (not shown) is used to penetratingly connect said electrical device and appliance with subsequent electrical power provided to the appliance.

[0023] Figure 1 also shows a faceplate or cover **13** for said box, and potential entry or exit aperture(s) **15** scored on said box through which uncut, sheathed cables can be introduced. After the sheathing is removed, each cable will in turn provide three insulated conductors with exposed, bare tips after the insulation is removed. These bare conductor tips or solid wires will then receive the appropriate wire nuts, according to polarity, as needed for power. It is to be understood that additional apertures may also provide cable access at the rear of the box or through other walls. A similar situation is contemplated for the box of this invention. The electrical device **11** is conveniently mounted to the front box **10** by screws **17** that align to penetrate one or more, threaded or unthreaded, ears, tabs, rails, or bosses **39** which were earlier formed during construction of either the electrical device or the outlet box. The faceplate **13** is then held to the box **10** opening by a separate screw **21** which penetrates a threaded aperture (not shown) located equidistantly between the sockets at the center of device **11**.

[0024] I now propose an electrical outlet box **18** of Figure 2 as a replacement for the currently employed Figure 1. As mentioned above, my box is readily formed of any suitable material of choice, such as metal, plastic, or the composites thereof. The exterior geometries of box **18** are essentially the same as those currently available, and it is mounted to a structure in the same manner

by simply forming an opening in a wall, ceiling, or floor. Moreover, conventional box mounting and cable gripping components of the art can also be used herein.

[0025] Interiorly positioned within box **18** are terminal blocks **20**, **22**, and **24** which will each accept solid wire conductor tips **29** according to their common polarity, including positive, neutral, and ground wires, as chosen by an electrician installing my box. It is to be noted that each terminal block may be an integral unit as shown on block **24** with a plurality of conductor receiving means **28** and a multiplicity of releasing means **30**. A typical receiving means as used herein is one or more rounded apertures within the exterior surface **35** of the terminal block as depicted in Figures 2-5. A typical releasing means herein is an elongated, vertical slot also generally depicted in Figures 2-5.

[0026] Alternatively, each terminal block may be comprised of one or more cells with each cell having one or more receiving means and one or more releasing means. A version of this latter terminal block is shown in Figure 2 as **20** and **22**. Consideration should be made to provide more or less cells when required for a particular application. It is also preferred that terminal blocks, regardless of whether in an integral or multi-cellular form, will have all receiving means **28** and all releasing means **30** aligned in a vertical and dimensionally spaced apart relationship as shown in Figures 2-5.

[0027] It is also preferred that these means be equally spaced apart from one another to allow and accommodate the placement or removal of solid conductor tips **29** as they are forcibly inserted or released by manual force of a tradesman or installer using a hand (to install) or a depression tool **32** (to release) said conductors **27** from my blocks. This is quickly done in a single forceful motion by the installer while holding said conductor or tool in the hand. Referring to Figure 5, the immediate result is the secure capture or release of the conductor tip **29** by a gripping means **34** of the terminal block. This provides a multitude of very secure, space-saving connections and/or releases by my outlet box. A simple form of the gripping means **34** is a spring set comprised of a base spring **36** and a flex spring **37** as further described herein.

[0028] My terminal blocks are secured to the internal surfaces of a conventional outlet box **10**, or my box **18**, by a plurality of fastening means **26** that are well accepted and known in the field of construction for electrical boxes and devices. For example, such means can be selected from ears, tabs, rails, bosses, studs, rivets, and screws. The exact selection of which is a matter of personal preference of the installer, or which will be earlier determined by a cost engineering evaluation during a design and analysis for fabrication of my box in commercial quantities. Said blocks are also reversible as shown in Figure 2 or can be manufactured in mirror image form per terminal block **23** of Figure 2. While the terminal blocks shown in Figures 2-5 are in rectangular form, it is also feasible that other geometric shapes could be possible, such as rounded, more smoother shapes, substantially tubular or oblong in form.

[0029] Figure 2 also shows therein a specific use of one or more pair(s) of tabs as fastening means **26** which will engage the top and bottom of the terminal block(s) along the exterior, outboard surface **25** and at a position remote from the box walls including side, top, bottom, and rear walls. A slight variation of this approach could involve engagement of groove(s) **23** within said blocks by these tabs. Alternatively, the fastening means **26** could also be positioned at the rear of the box **10** and engage the front, exterior surface **35** (not shown) of the block remote from the rear wall; or it could engage a similar groove **23** that is horizontally formed along its exterior **35** (not shown). Also dependent upon cost engineering studies, it is likely that my box, terminal blocks, and associated components will be molded in multi-step production processes to manufacture commercial quantities.

[0030] Referring now to Figures 3 and 4, a typical procedure for the deployment of my box **18** calls for the removal of insulation at the tip **29** of conductor **27** to expose a bare metal surface of sufficient length to penetrate the receiving means **28** and thereafter engage the gripping means **34** that is located within a body cavity of the terminal block. It should be understood that the tips are resting on the top of the gripping means and that their actual insertion is

more clearly shown in Figure 4. Moreover, the depression tool **32** is required only to release the conductor tips which is more clearly shown in Figure 5.

[0031] Specifically referring to Figure 4, the metal spring set of the cell **33** from Figure 3 is depicted in greater detail. For reference, the cell **33** is an enlarged section taken from the encircled portion of terminal block **20** in my Figure 2. The subject cell in Figure 4 is rotated on its back approximately 90° and is viewed from the bottom to reveal therein two metal springs **36** and **37** of L-shaped form. One can see that the elongated, L-shaped spring **37** is larger than its counterpart L-shaped spring **36**. This design allows spring **37** to readily flex when bare conductor tips **29** are hand-pushed into receiving means **28**, or when it is depressed by tool **32** to release and remove conductor tips **29**. In sharp contrast, the smaller spring **36** functions as a rigid, base-spring and allows the conductor tip **29** to become wedged by manual insertion between itself and flex spring **37**. If desired, the larger spring **37** can also be scored, slotted, notched or perforated to be more resilient or flexible.

[0032] The aforementioned springs are made of conductive metal and are totally embedded within the terminal block or cell in a suitable way to insolate and insulate them from each other and the body cavity in which they are located. The springs utilized herein are selected from metals or metal alloys of copper, brass, beryllium-cooper, and similar conductive materials that possess both reduced oxidation properties and springy characteristics. If need be, these springs can also be permanently attached within the body cavity of the cell or terminal block by the use of additional fasteners **26** or by a multi-step molding process. Thereby, said springs are rigidly mounted within said cell or block by ears, tabs, rails bosses, studs, rivets, screws, and structural design elements or flashings of a plastic molding process.

[0033] Proper precautions should be taken, with due regard for avoiding electrical shock, when it is desired to electrically disconnect a conductor arrangement. Namely, the power should be shut off. Disconnection is performed then by reversing the installation procedure and using a depression tool **32** within the releasing means **30** to access gripping means **34** whereby the flex spring **37**

is engaged and opened to release the conductor tip **29** from the spatial gap of the spring set between springs **36** and **37**. As used herein, the depression tool can be a screw driver, awl, or like pointed tool with an insulated handle. The end opposite of the handle has a tip that is capable of penetration of releasing means **30** sufficiently to depress or relieve the tension of spring **37** against the conductor tip **29**. The conductor tip is then removed from receiving means **28**. The overall process is further depicted in Figure 5 which relates to an end view section of the top cell **33** of terminal block **20**. This view is taken along the line 5-5 of Figure 4.

[0034] I wish it understood that I do not desire to be limited to the exact details of construction or method shown herein since obvious modifications will occur to those skilled in the relevant arts without departing from the spirit and scope of the following claims.